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Atmospheric Measurement Techniques Discussions

Interactive comment on "Retrieving Vertical Ozone Profiles from Measurements of Global Spectral Irradiance" *by* Germar Bernhard et al.

Anonymous Referee #1

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General comments

This paper describes a new technique to retrieve vertical resolved ozone from direct sun and upper hemisphere ultraviolet (zenith to pole) measurements. It includes validation of the retrievals with the Microwave Limb Sounder, Ozone Monitoring Instrument, and ozonesonde measurements as well as discussion of comparison of retrieval biases with similar methods such as the standard zenith sky Umkehr technique.

This is a very good paper that is well within the scope of AMT, well written, and will be of general interest to the ozone community, especially those that have similar data available. My main comments are: considering that this paper may lead to retrieval of more historical ozone information in addition to what is already available (ozonesondes, Dobson Umkehr, etc.). I would like to see a bit more discussion on the temporal and

spatial availability of the measurements. Consistent (Zenith-sky and Global-Umkehr) naming conventions would be nice to avoid any confusion. I would also like to see some discussion of the local times that MLS passes over summit and seasonal change in the averaging kernel (if any). I recommend publication of this paper after those and the following clarifications and changes.

Specific comments

Page 1, line 26: I would like to see a short explanation of what this measurement (the direct sun plus upper hemisphere) is typically used for.

Page 2, line 2 and line 21 and Section 2.2: You mention that there are other sites that have these UV detectors. It would be nice to have some general information about how many potential sites there are, their temporal measurement range, are there any Southern Hemisphere sites, and there many locations where there are not any Umkehr measurements, etc. It is briefly mentioned in the conclusions that there are many sites with time series of greater than 25 years, but this is not mentioned anywhere else.

Page 3, line 4: Why not use the more recent ozone cross section studies? https://www.atmos-meas-tech.net/7/609/2014/

Page 4, line 19: You mention on line 14 that a σ_a value of .1 is small and therefore very sensitive to the a priori. However, you go on to say on line 19 that $\sim$.1 is the standard deviation of the MLS profiles. I feel this needs clarification as you mention that σ_a is the anticipated variability (standard deviation) and therefore using a value higher than .1 (for example .4) means you are expecting a larger variability in the retrieval.

Page 10, line 1: What two times of day are MLS measurements taken at the latitude of Summit? Are there any inconsistencies here, diurnal effects, polarisation?, etc?

Page 15, Fig. 4: It would be interesting to see if the change in season (thus, the vertical structure of the ozone profile) modifies the structure of the relative averaging kernels, especially, as fall and spring statistics are compared later on in Table 2.

Page 15, Fig 4: Also, why are the σ_a = .4 plots not shown in this figure? It would be interesting to see if the inversion agrees well in this case when it has more freedom due to a larger a priori covariance. If you have the results, they could also just be mentioned in the text.

At the beginning of the paper, you define Umkehr to refer to the standard zenith sky Umkehr technique and Global-Umkehr to refer to direct sun plus upper hemisphere. However, throughout the text and especially in the discussion you refer to Global-Umkehr as just Umkehr which is confusing. I suggest keeping the naming conventions consistent throughout the text.

Technical corrections

Page 1, line 11: Substitute ultraviolet for UV.

Page 1, line 18: The OMI acronym does not need to be included here as it is not repeated in the abstract. It is redefined in the main text.

Page 2, line 4: Double closed bracket.

Page 7, line 2: Is the AFGL acronym defined (Air Force Geophysics Laboratory)?

Page 14, line 11: suggest changing identical to virtually identical as there is a small difference of 1 DU as seen in Figure 4.

Page 15, line 7: Confusing sentence, suggest to change: ...they do not allow to assess the Global-Umkehr technique comprehensively. to something like they do not allow the comprehensive assessment of the Global-Umkehr technique.

Page 5, line 10: Spaces seem to be present between all equations and symbols and full stops, commas. This can be misleading in some instances. For example, Page 5, line 10 may be interpreted as a dot product.

Table 1. There are spaces on either side of the endashes which are not consistent with endash ranges throughout the text.

Page 10, line 1: typo - MLS measure(s) thermal... - remove "s"

Page 10, line 15: space after second open bracket.

Page 10, line 24: Suggest remove therefore or move to the start of the sentence - Therefore,...

Page 17, line 15: should N be in parenthesis?

Page 19, line 8: Change Table 2 allows to assess retrievals... to something like Table 2 allows the assessment of retrievals...

Page 19, lines 12 and 13: change to to between -6 % to 4 % and to between -5 % to 2 %

Page 19, line 18: remove is

Page 19, lines 19 and 21: insert a space after the equals sign

Page 19, line 19: Change to but it is consistent

Page 19, line 20: remove comma after standard

Page 20, line 8: Is (/2) meant to be there?

Page 20, line 23: change resembles to "resemble

Page 22, line 8: change to ...have to be...

Page 22, line 24: change to ...2–3 % of those... (use an endash?)

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